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EXAMINER	
HORNING, JOEL G	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

PTOL-90A (Rev. 04/07)

Office Action Summary	Application No.	Applicant(s)	
	10/594,284	WITZMANN ET AL.	
	Examiner	Art Unit	
	JOEL HORNING	1712	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *19 January 2012*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *2-6,8,17-19 and 21-27* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *2-6,8,17-19 and 21-27* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

1. **Claims 22, 23, 26 and 27** are rejected under 35 U.S.C. 103(a) as being unpatentable over Recasens et al (US 3837870) in view of Wang et al (Applied Surface Science **221** (2004) 293-301) in view of Li (WO 95/35269, as previously supplied by applicant).

Recasens et al is directed towards the formation of refractory bricks (zirconium containing bricks), specifically ones to be used in glass furnaces (abstract) because of its high resistance to corrosion by molten glass (when the bricks are placed in contact with a glass melt during processing of the glass melt in the furnace). Its composition comprises alumina, silica, zirconia and chromium oxide and produces a desirable vitreous phase (col 1, lines 29-40), Recasens et al

further teaches that the inclusion of zirconia into the refractory adds plasticity to the composition which reduces cracking in the resulting refractory bricks (col 3, lines 19-30).

Wang et al is directed towards a process for treating the surface of refractory bricks which, like Recasens et al, also comprises alumina, silica and zirconia (abstract). These bricks are, like Recasens, to be used as linings for furnaces which will be in contact with molten glassy material (slag). Wang et al, also like Recasens, recognizes that ingress of the glassy material into the refractory bricks causes corrosion and erosion of the refractory, which is undesirable. In order to solve this problem, Wang et al teaches eliminating cracks and porosity from the surface of the refractory, sealing it (Introduction). This is performed by exposing the refractory surface to CO_2 laser radiation, which seals the surface (closed) porosity and can result in a crack-free, dense laser treated layer on the refractory (abstract). The resulting layer structure is taught to have no apparent cracks or flaws, it is closed (section 3.2).

Thus it would have been obvious to a person of ordinary skill in the art at the time of invention to treat the refractory composition of Recasens et al by a laser treatment process as suggested by Wang et al: closing the porosity in a surface layer of the refractory in order to improve its corrosion resistance to molten glass, which the refractory would be in contact with when used in the intended glass furnace of Recasens et al.

Regarding the limitation that the laser treatment layer of the refractory be vitreous, it is not clear from Recasens and Wang whether the produced structure would be vitreous.

Li is also directed towards a process of laser treating bricks (abstract) with similar constituents (page 1) in order to seal their porosity so as to solve the same problem of how to protect brick surfaces from harsh environments: to produce a "protective, impermeable coating for use in a chemical ... plant" (page 2, paragraph 7). Li further teaches that the bricks so sealed (closed surface without apparent cracks or flaws) can have an amorphous (vitreous) surface which is used to protect the underlying material of the brick (page 3, paragraphs 3-4). The examiner notes that Li teaches accomplishing this using a CO_2 laser (page 3, ¶8) operated at low power densities, such as 2-2.5 W/mm^2 (page 4, ¶2), which overlaps with applicant's taught energy levels for the laser.

Thus it would have been obvious to a person of ordinary skill in the art at the time of invention to perform the laser treatment in the process of Recasens in view of Wang in the manner taught by Li so that the treated surface is vitreous because it was a known structure for laser treated bricks to develop and was known (to Recasens as well as Li) to be particularly useful for protecting the underlying brick material from degradation in a chemical process (e.g. glass slag contact).

Since the refractory material is what is modified by the laser to produce the closed layer, the closed layer will contain materials from the refractory material. Tempering is not required by the process.

Furthermore, since the intent of Recasens et al is to use the refractory in glass furnaces where they are in contact with a glass melt, it is obvious to process a glass melt with it in contact with the closed vitreous layer of the refractory of Recasens et al in view of Wang et al **(claim 22)**.

Regarding **claim 23**, the additional step of spraying the surface with a powder or solution is not required.

2. Regarding **claims 26 and 27**, Li does not teach that any of the brick material is removed during the laser processing. When a reference discloses the limitations of a claim except for a property, and the Examiner cannot determine if the reference inherently possesses that property (in this case, that no brick material is removed during the process), the burden is shifted to Applicant(s). In re Fitzgerald, USPQ 594 and MPEP §2112.

Regarding whether applicant would expect the laser treatment of the bricks to remove material, as noted above Li teaches accomplishing the laser sealing process using a CO_2 laser (page 3, ¶8) operated at low power densities, such as 2-2.5 W/mm^2 with scan rates of 1-200mm/sec (page 4, ¶2). Li does not teach what the beam diameter should be. However, Wang teaches using a beam diameter of 4mm and a scanning velocity of 4-12mm/s (which overlaps with applicant's claimed values) (section 2). Thus it would have been obvious to a person of ordinary skill in the art at the time of invention to perform the laser sealing process as described in Li on the bricks with a beam diameter of 4mm since it was taught to be appropriate conditions when sealing these bricks using a CO_2 laser.

On page 3, lines 15-19 of applicant's specification, applicant teaches that under these conditions the result will be "a closed, vitreous layer on the surface of the refractory material, without any material having been removed." Thus by performing the laser sealing process under normal known conditions of the prior art the applicant teaches that no material will be removed.

Li teaches that contamination might be removed during the laser treatment (page 3, ¶5), however, it would have certainly have been obvious to a person of ordinary skill in the art at the time of invention to perform the process on a brick that had no contamination because contamination (by definition) is not desired to be present.

3. **Claims (2-6)/17, 17-19, 21 and 25** are rejected under 35 U.S.C. 103(a) as being unpatentable over Recasens et al (US 3837870) in view of Wang et al (Applied Surface Science **221** (2004) 293-301) in view of Li (WO 95/35269, as previously supplied by applicant) as applied to claim 22, further in view of Torok et al (US 3360353) as evidenced by Triantafyllidis et al (Applied Surface Science 186(2002) 140-144).

Recasens et al in view of Wang et al in view of Li does not teach using their treated refractory bricks suitable for use in a glass furnace specifically in a Danner blowpipe section of a glass furnace.

However, Torok teaches a furnace and method for producing glass wherein molten glass is in contact with a refractory coated mandrel during the process (abstract) and the mandrel can be a Danner blowpipe (col 1, lines 45-60). Torok

teaches that the refractory material on the mandrel is formed of several uniform diameter segments, which can be considered bricks (col 3, lines 68-75). Torok further teaches that the refractory bricks of the Danner blowpipe erode as the molten glass is in contact, forming glass tubing. This causes defects in the produced glass tubing which necessitates replacing the refractory material in a time consuming process (col 1, line 62 through col 2, line 14).

Thus it would have been obvious to a person of ordinary skill in the art at the time of invention to use the laser treated refractory bricks of Recasens et al in view of Wang et al in view of Li in the Danner blowpipe and glassmaking process of Torok since they were refractory bricks suitable for such furnaces and it would reduce the erosion of the refractory bricks, allowing the production of longer sections of high quality pipe and increase the period between time consuming replacements of the refractory bricks of the blowpipe

Tempering is not required by the claim **(claim 17)**.

4. Regarding **claim 2/17**, Wang et al teaches that alpha alumina and metastable zirconia melt during their process and both melting temperatures are above 2000°C, within the claimed range, so the refractory is heated to temperatures within this range (section 4.2).

5. Regarding **claim (4-5)/17,** Wang teaches using a beam diameter of 4mm and a scanning velocity of 4-12mm/s (which overlaps with applicant's claimed values) (section 2), so that the exposure time is ~0.33-1 second.

6. Regarding **claims (3-5)/17**, Wang et al teaches that the power, beam diameter and the beam scanning rate are operating parameters (from these parameters, the power density and the exposure time can be determined, so they are equally known as operating parameters), which are all result effective variables for controlling the smoothness and surface cracking in the resulting laser treated surface (section 2 and section 3.1). Likewise, Li teaches that appropriate energy levels for the laser in order to seal these surfaces is 2-2.5W/mm^2, which lies within applicant's claimed ranges with scanning rates that overlap with applicant's claimed range (page 4, ¶2-3).

Thus, it would have been obvious to one of ordinary skill in the art at the time of invention to choose the instantly claimed ranges of "a power density of 2 to 4W/mm^2" **(claim 3/17),** "an effective exposure time of 0.1 to 5 s" **(claim 4/17)**, "a scan rate of 1-10 mm/s" and a laser beam "diameter of 2-5 mm" **(claim 5/17)** through process optimization, since it has been held that when the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. See In re Boesch, 205 USPQ 215 (CCPA 1980).

Thus it would have been obvious to a person of ordinary skill in the art at the time of invention to choose a power density of 2 to 2.5W/mm^2 since Li teaches that power range to be effective at sealing brick surfaces and producing glassy surfaces **(claim 3/17).**

7. Regarding **claim 6/17**, Triantafyllidis et al teaches that CO_2 lasers have a wavelength of 10.6 microns (page 141, section 2), which is within applicant's claimed range.

8. Regarding **claim 18,** from figure 3b of Wang et al, the surface layer is shown to be more than 100 microns but not more than 1000 microns, which is within applicant's claimed range.

9. Regarding **claim 19**, since the refractory material is what is modified by the laser to produce the closed layer, the closed layer will contain materials from the refractory, including aluminum and zirconium.

10. Regarding **claim 21**, since the laser treatment is performed on the refractory bricks that are later placed into the Danner blowpipe which is then used in contact with a glass melt, the laser treatment to produce the closed vitreous layer is clearly performed before contact with the glass melt.

11. **Claim 25** is rejected for the same reasons claims 26 and 27 were previously, but now in view of the current rejection.

12. **Claims 8, (2-6)/8 and 24** are rejected under 35 U.S.C. 103(a) as being unpatentable over Recasens et al (US 3837870) in view of Wang et al (Applied Surface Science **221** (2004) 293-301) in view of Li (WO 95/35269, as previously supplied by applicant), further in view of Torok et al (US 3360353) as applied to claim 17 above, further in view of Petitbon (US 4814575).

Claim 8 further requires that the surface be sprayed with a powder or a solution before or during the laser treatment or that the ceramic body be infiltrated with a solution that includes zirconium or aluminum containing compounds.

Recasens et al in view of Wang et al in view of Li in view of Torok et al is directed towards methods of laser treating ceramic bodies so that the amount of porosity on the surface of the refractory is decreased, which improves the corrosion and spalling resistance of the refractory. Li further teaches coating the surface prior to the laser treatment with a solution of refractory material, so that is forms part of the sealed surface of the brick. It teaches using materials which are present in the bricks in the coating, such as siliceous materials (page 3 ¶4), but it does not specifically teach including components that contain aluminum or zirconium.

However, Petitbon is also directed towards methods of laser treating ceramic bodies so that their surface porosity is reduced. It teaches that by spraying a ceramic powder onto the substrate during the laser treatment, so that the powder and substrate surface melt, the molten powder particles will fill available surface porosity, thus reducing the presence of porosity or microcracks on the substrate surface, improving the microstructure and improving the properties (thermal expansion coefficient, residual stress, etc) of the surface (col 2, line 40 through col 3, line 13). It teaches using the materials present in the substrate as the powder sprayed onto the substrate, such as when the substrate is zirconia or alumina based using zirconia or alumina powder to fill the cracks in the substrate (col 4, lines 30-35).

Thus it would have been obvious to a person of ordinary skill in the art at the time of invention performing the process of Recasens et al in view of Wang et al in view of Torok et al to spray a powder or solution of material that is present in the substrate, such as aluminum or zirconium, at the substrate so that they melt together during laser treatment in order to fill surface porosity or microcracks that may be present in the final surface, thus increasing the corrosion and spalling resistance as well as other properties of the substrate **(claim 8)**.

13. **Claims (2-6)/8** are rejected for the same reasons they were previously, but now in view of Petitbon.

14. Claim 24 is rejected for the same reasons claims 26 and 27 were previously, but now in view of the current rejection.

Response to Arguments

15. Applicant's arguments filed January 19th, 2012 have been fully considered but they are not persuasive.

Section II

16. Applicant first argues that Recasens teaches away from strengthening the bricks resistance to corrosion by laser treatment because it teaches a different method of improving the corrosion resistance of the bricks. Does Recasens teach that their method permanently renders the brick surface impervious to corrosion? Since it does not, a practitioner is strongly motivated to employ different mitigation methods and their combinations in order to produce increasingly durable bricks. This is not a teaching away.

17. Applicant argues that the obviousness rejection does not need to rely on Recasens because Wang teaches using a similar brick composition. However, as stated in the rejection, Recasens is used. One of the primary reasons Recasens was used it because it specifically teaches that the inclusion of a vitreous phase in the bricks results in superior corrosion resistance compared to other bricks with less or no vitreous phase (col 1, lines 29-40), motivating a practitioner to maintain the vitreous phase in the bricks even after a laser processing. Li teaches how a practitioner can perform a laser sealing process on bricks while reliably maintaining a vitreous phase, either by laser power, compositional changes, or applying glass forming material to the surface during the laser treatment.
18. Applicant then states that a person skilled in the art would know that the compositions in Recasens can only be used for melting low temperature glass batches. However, even if true (though the examiner does not know if that is so), it is not dispositive to the case since the claims do not require melting high temperature glass batches.
19. Regarding applicant's arguments that the brick of Wang is crystalline and the specific laser treatment of Wang causes it to remain crystalline rather than vitreous, As discussed above, Recasens is used to motivate maintaining a vitreous component in the brick surface and Li is used to teach how to maintain a vitreous component in the brick surface, so Wang does not need to.
20. Regarding applicant's argument that if a brick has a dominant crystalline phase it cannot be considered to be vitreous. However, if a material has a vitreous phase,

calling it vitreous is an accurate description of that material and reasonably reads upon the claim limitation.

21. Applicant then argues that the bricks of Li are somehow compositionally different than applicant's claimed bricks. Whether or not this is true, Li is not being used to teach a particular composition of brick, but rather how to produce the desired vitreous surface on the laser treated surface, so this argument is not convincing. This involves making certain enough glass former remains on the substrate surface after laser treating to leave a vitreous phase, but that is what Recasens, Wang and Li each disclose, so it is not unexpected or unpredictable that a sufficient amount of silica needs to be at the surface for there to be a vitreous phase. Likewise, what causes sufficient glass former to remain is also explained in these references. Recasens includes more silica in its composition in order to allow the vitreous phase to form. Wang teaches that silica is removed by evaporation, and that the material being heated to too high a temperature (by too powerful of an energy dose, which they happened to control by scanning speed) causes this evaporation to be increased. Li teaches that silica can even be added during deposition in order to ensure a sufficient amount is at the substrate surface. Thus a person of ordinary skill in the art at the time of invention would have been motivated to keep the silica phase to increase the corrosion resistance of the coating (as taught by Recasens), would have understood the physical mechanism of vitreous phase loss by evaporation (e.g. Wang) and would have known several methods by which to control this evaporative loss of silica vitreous phase forming material (e.g. add more silica to

the initial brick material, reduce the intensity of the laser treatment, or supplement the silica phase by depositing it on the surface during laser treatment).

22. Applicant then argues that their requirement that a certain power density be "introduced into the surface" actually means that that power density is what is absorbed by the surface, which might make it a different power level than disclosed by Li due to reflection of the laser power. However, the obviousness statement is based upon optimization of the laser energy, and the breadth of disclosure found in Li alone or Wang and Li clearly covers applicant's desired absorption levels in order to produce the desired sealing effect, so the argument is not convincing.

Section III

23. Triantafyllidis is being used to evidence the fact that CO2 lasers produce light with a wavelength of 10.6 microns. It does not need to teach other features of the claim.

Section IV

24. Regarding applicant's argument that Petitbon, like Wang, uses too high a laser power in order to produce a vitreous surface. However, Li is being used to teach applying material during laser processing and those laser powers, so Petitbon does not need too. Petitbon is being used to teach that aluminum and zirconium were specifically known materials to include in such applied coatings.

25. Applicant then argues that the formation of a vitreous surface would not have been predictable based upon the prior art teachings. However, as discussed above, Recasens, Wang and Li each disclose that making a vitreous phase on the surface simply requires having enough glass former material in substrate surface after laser

treating so that it can form a vitreous phase, so it is not unexpected or unpredictable that a sufficient amount of silica needs to be at the surface for there to be a vitreous phase. Likewise, what causes sufficient glass former to remain is also explained in these references. Recasens includes more silica in its composition in order to allow the vitreous phase to form. Wang teaches that silica is removed by evaporation, and that the material being heated to too high a temperature (by too powerful of an energy dose, which they happened to control by scanning speed) causes this evaporation to be increased. Li further teaches that silica can even be added during deposition in order to ensure a sufficient amount of glass former is at the substrate surface. Thus a person of ordinary skill in the art at the time of invention would have been motivated to keep the silica phase to increase the corrosion resistance of the coating (as taught by Recasens), would have understood the physical mechanism of vitreous (silica) phase loss by evaporation (e.g. Wang) and would have known several methods by which to control this evaporative loss of silica vitreous phase forming material (e.g. add more silica to the initial brick material, reduce the intensity of the laser treatment, or supplement the silica phase by depositing it on the surface during laser treatment). This lead the examiner to conclude that a practitioner would have expected to be able to produce a vitreous phase with no more than a reasonable amount of experimentation.

26. Regarding applicant's argument that the prior art references do not teach how to eliminate crystalline phases from the laser treated surface, the claims do not require this, so they do not need to.

27. Regarding applicant's argument that Li requires that the brick comprise more than 50 wt % of silica in order to form a glassy phase, Li does not teach this. The closest thing to this taught by Li is that "[i]n all of these kinds of bricks, SiO_2 exists as one of the principal components." Even from context, it is obvious that there cannot be more than one component that a majority of the brick is made from, so "principal component" does not mean that most of the brick is formed from that component. Rather, it means that SiO2 is one of the more plentiful components of the brick: not a dopant. The bricks of Recasens also have SiO2 as one of their principal components, as can be compared with the minor components, such as Na2O, K2O, etc (abstract). Thus there is no reason to believe that a majority of the brick must be SiO2 before a vitreous phase can form after laser treatment.

Conclusion

28. No current claims are allowed.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JOEL HORNING whose telephone number is (571)270-5357. The examiner can normally be reached on M-F 9-5pm with alternating Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael B. Cleveland can be reached on (571)272-1418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/JOEL G HORNING/
Examiner, Art Unit 1712

/David Turocy/
Primary Examiner, Art Unit 1717